What is claimed is:

1. A rod lens comprising:

a reflecting portion generating a reflected light by reflecting at least a portion of an incident light; and

a rod lens main body of substantially a cylindrical shape generating a transmitted light by transmitting at least a remaining portion of the incident light, the rod lens main body having an axis and a circumferential side surface extending along the axis, the circumferential side surface being substantially cylindrical in shape and encircling the axis in a circumferential direction, the reflecting portion and the rod lens main body cooperating to generate a line beam made from both of the reflected light and the transmitted light.

2. A rod lens according to Claim 1, wherein the reflecting portion includes a light separating portion, which is formed on at least a part of the circumferential side surface of the rod lens main body along the circumferential direction and which separates the incident light into both of the transmitted light and the reflected light.

3. A rod lens according to Claim 2, wherein the light separating portion is formed in an area of the circumferential side surface defined around the axis with an angle of 2ϕmax (radians) that satisfies the following two

inequalities:

$$4\phi \max - 2\sin^{-1}\left(\frac{\sin\phi \max}{n}\right) - \pi \geq 0$$

$$2\phi \max \leq \pi,$$

wherein the rod lens main body has a refractive index n and a ratio of a circumference of a circle to the diameter of the circle is π.

4. A rod lens according to Claim 3, wherein the refractive index of the rod lens main body is 1.5, and wherein the light separating portion is formed on the circumferential side surface to spread around the axis with an angle whose amount has a value greater than or equal to approximately 35.17% of the entire angle 2π for the entire circumferential side surface in the circumferential direction and smaller than or equal to approximately 50% of the entire angle 2π for the entire circumferential side surface in the circumferential direction.

5. A rod lens according to Claim 2, wherein the light separating portion includes a light separating film formed over the at least a part of the circumferential side surface.

6. A rod lens according to Claim 1, wherein the reflecting portion includes a light reflecting region which is formed over a part of the circumferential side surface along the circumferential direction and which receives and reflects a portion of the incident light,

wherein the rod lens main body includes a transmitting region which receives and transmits the remaining portion of the incident light.

7. A rod lens according to Claim 6, wherein the light reflecting region includes: a first reflecting region and a second reflecting region which are formed on the circumferential side surface at two regions separated from each other in the circumferential direction, and

wherein the transmitting region is defined as an area between the first and second reflecting regions on the circumferential side surface in the circumferential direction.

8. A rod lens according to Claim 7, wherein each of the first and second reflecting regions has a centerline extending parallel to the axis, the centerlines being separated from each other by an angle of approximately 120° about the axis.

9. A rod lens according to Claim 8, wherein each of the first and second reflecting regions is formed on the circumferential side surface of the rod lens main body as being centered about the corresponding centerline and as covering an angle of approximately 60° about the axis.

10. A rod lens according to Claim 1, wherein the reflecting portion includes a reflecting member which is disposed near the rod lens main body and which generates a

reflected light by receiving and reflecting a portion of the incident light in a direction toward the rod lens main body, and

wherein the rod lens main body generates a line beam by transmitting both of the remaining portion of the incident light and the reflected light.

11. A rod lens according to Claim 10, wherein the reflecting member includes at least two reflecting members,

wherein the axis of the rod lens main body extends substantially perpendicularly to an optical axis of the incident light, and

wherein each reflecting member extends along the axis of the rod lens main body and forms a predetermined angle with respect to the optical axis of the incident light, thereby reflecting the light incident to the reflecting member toward the rod lens main body.

12. A rod lens according to Claim 11, wherein each reflecting member has a reflecting surface that contacts the circumferential side surface of the rod lens main body.

13. A rod lens according to Claim 11, wherein the predetermined angle is greater than approximately 0° and less than or equal to approximately 30°.

14. A rod lens according to Claim 11, wherein the predetermined angle has a value α that satisfies the following inequality:

$$\frac{1}{\sqrt{n^2-1}} \leqq \left| \frac{\sin 2\alpha \cos\alpha + \sin\alpha \cos 2\alpha}{\sin 2\alpha(\sin 2\alpha + \sin\alpha) - \cos 2\alpha(\cos\alpha - \cos 2\alpha)} \right| ,$$

wherein the rod lens main body has a refractive index n.

15. A rod lens according to Claim 1, wherein the reflecting portion includes a support member that holds the rod lens main body and that has at least two reflecting surfaces,

wherein the axis of the rod lens main body extends approximately perpendicularly to an optical axis of the incident light, and

wherein each reflecting surface extends along the axis of the rod lens main body, contacts the circumferential side surface of the rod lens main body, and forms a predetermined angle with respect to the optical axis of the incident light.

16. A line-beam generating optical system, comprising:

a light source emitting a light beam along an optical axis;

a collimating lens converting the light beam emitted from the light source into a collimated light; and

a rod lens including:

a reflecting portion generating a reflected light by reflecting at least a portion of the collimated light that falls incident on the rod lens along the optical axis; and

a rod lens main body of substantially a cylindrical shape generating a transmitted light by transmitting at least a remaining portion of the incident collimated light, the rod lens main body having an axis that extends substantially perpendicularly to the optical axis and a circumferential side surface extending along the axis, the circumferential side surface being substantially cylindrical in shape and encircling the axis in a circumferential direction, the reflecting portion and the rod lens main body cooperating to generate a line beam made from both of the reflected light and the transmitted light.

17. A line-beam generating optical system according to Claim 16, wherein the reflecting portion includes a light separating portion, which is formed on at least a part of the circumferential side surface of the rod lens main body along the circumferential direction and which separates the incident light into both of the transmitted light and the reflected light.

18. A line-beam generating optical system according to Claim 17, wherein the light separating portion is formed in an area of the circumferential side surface defined around the axis with an angle of 2ϕ max (radians) that satisfies the following two inequalities:

$$4\phi \max - 2\sin^{-1}\left(\frac{\sin\phi \max}{n}\right) - \pi \geq 0,$$

$2\phi \max \leq \pi$,

wherein the rod lens main body has a refractive index n and a ratio of a circumference of a circle to the diameter of the circle is π.

19. A line-beam generating optical system according to Claim 18, wherein the refractive index of the rod lens main body is 1.5, and wherein the light separating portion is formed on the circumferential side surface at its side, on which the incident light falls incident, to spread around the axis with an angle whose amount has a value greater than or equal to approximately 35.17% of the entire angle 2π for the entire circumferential side surface in the circumferential direction and smaller than or equal to approximately 50% of the entire angle 2π for the entire circumferential side surface in the circumferential direction.

20. A line-beam generating optical system according to Claim 17, further comprising a half mirror separating the collimated light into a first reflected collimated light and a first transmitted collimated light;

wherein the rod lens includes:

a first rod lens disposed on an optical path of the first reflected collimated light; and

a second rod lens disposed on an optical path of the first transmitted collimated light, thereby forming

at least two line beams.

21. A line-beam generating optical system according to Claim 20, wherein each of the first and second rod lenses has the light separating portion,

wherein the light separating portion of each rod lens is formed in an area of a circumferential side surface of the corresponding rod lens main body at its side, on which the corresponding collimated light falls incident, the area being defined around the axis with an angle of 2 ϕ max (radians) that satisfies the following two inequalities:

$$4\phi \max - 2\sin^{-1}\left(\frac{\sin\phi \max}{n}\right) - \pi \geq 0,$$

$$2\phi \max \leq \pi,$$

wherein the corresponding rod lens main body has a refractive index n and a ratio of a circumference of a circle to the diameter of the circle is π.

22. A line-beam generating optical system according to Claim 20, wherein the half mirror transmits the first reflected collimated light, which has been reflected off the half mirror and which has been reflected by the first rod lens to return to the half mirror, thereby obtaining another transmitted collimated light by transmitting the first reflected collimated light through the half mirror.

23. A line-beam generating optical system according to Claim 18, further comprising a half mirror separating the

collimated light into a reflected collimated light and a transmitted collimated light,

wherein the rod lens includes at least one of a rod lens disposed on an optical path of the reflected collimated light and another rod lens disposed on an optical path of the transmitted collimated light.

24. A line-beam generating optical system according to Claim 17, wherein the light separating portion includes a light separating film formed over the at least a part of the circumferential side surface in the circumferential direction.

25. A line-beam generating optical system according to Claim 16, wherein the reflecting portion includes a light reflecting region which is formed over a part of the circumferential side surface along the circumferential direction and which receives and reflects a portion of the incident collimated light,

wherein the rod lens main body includes a transmitting region which receives and transmits the remaining portion of the incident light.

26. A line-beam generating optical system according to Claim 25, wherein the light reflecting region includes: a first reflecting region and a second reflecting region which are formed on the circumferential side surface at its side, on which the collimated incident light falls incident, the

first reflecting region and the second reflecting region being formed at two regions separated from each other in the circumferential direction, and

wherein the transmitting region is defined as an area between the first and second reflecting regions on the circumferential side surface in the circumferential direction.

27. A line-beam generating optical system according to Claim 26, wherein each of the first and second reflecting regions has a centerline extending parallel to the axis, the centerlines being separated from each other by an angle of approximately 120° about the axis.

28. A line-beam generating optical system according to Claim 27, wherein each of the first and second reflecting regions is formed on the circumferential side surface of the rod lens main body as being centered about the corresponding centerline and as covering an angle of approximately 60° about the axis.

29. A line-beam generating optical system according to Claim 25, further comprising a half mirror separating the collimated light into a first reflected collimated light and a first transmitted collimated light;

wherein the rod lens includes:

a first rod lens disposed on an optical path of the first reflected collimated light; and

a second rod lens disposed on an optical path of the first transmitted collimated light, thereby forming at least two line beams.

30. A line-beam generating optical system according to Claim 29, wherein the half mirror transmits the first reflected collimated light, which has been reflected off the half mirror and which has been reflected by the first rod lens to return to the half mirror, thereby obtaining another transmitted collimated light by transmitting the first reflected collimated light through the half mirror.

31. A line-beam generating optical system according to Claim 25, further comprising a half mirror separating the collimated light into a reflected collimated light and a transmitted collimated light,

wherein the rod lens includes at least one of a rod lens disposed on an optical path of the reflected collimated light and another rod lens disposed on an optical path of the transmitted collimated light, thereby forming at least one line beam.

32. A line-beam generating optical system according to Claim 16, wherein the reflecting portion includes a reflecting member which is disposed near the rod lens main body and which generates a reflected light by receiving and reflecting a portion of the incident collimated light in a direction toward the rod lens main body, and

wherein the rod lens main body generates a line beam by transmitting both of the remaining portion of the incident collimated light and the reflected light.

33. A line-beam generating optical system according to Claim 32, wherein the reflecting member includes at least two reflecting members, and

wherein each reflecting member extends along the axis of the rod lens main body and forms a predetermined angle with respect to the optical axis of the incident collimated light, thereby reflecting the collimated light incident to the reflecting member toward the rod lens main body.

34. A line-beam generating optical system according to Claim 32, wherein the reflecting member has a reflecting surface that contacts the circumferential side surface of the rod lens main body and forms a predetermined angle with the optical axis of the collimated light, thereby reflecting the received portion of the collimated light toward the rod lens main body, and

the rod lens main body converts, into a line beam, both of the portion of the collimated light reflected by the reflecting member and the remaining portion of the collimated light that falls directly incident on the rod lens main body.

35. A line-beam generating optical system according to Claim 34, wherein the predetermined angle is greater than

approximately 0° and less than or equal to approximately 30°.

36. A line-beam generating optical system according to Claim 32, wherein the collimating lens emits, toward the rod lens, the collimated light having a beam diameter in a cross section substantially perpendicular to the optical axis of the collimated light, the beam diameter being greater than the diameter of the rod lens main body.

37. A line-beam generating optical system according to Claim 16, wherein the reflecting portion includes a support member that holds the rod lens main body and that has at least two reflecting surfaces, and

wherein each reflecting surface extends along the axis of the rod lens main body, contacts the circumferential side surface of the rod lens main body, and forms a predetermined angle with respect to the optical axis of the incident collimated light.

38. A line-beam generating optical system according to Claim 37, wherein the predetermined angle is greater than approximately 0° and less than or equal to approximately 30°.

39. A line-beam generating optical system according to Claim 32, wherein the collimating lens emits, toward the rod lens, the collimated light having a beam diameter in a cross section substantially perpendicular to the optical axis of the collimated light, the beam diameter being greater than a value equal to zero times as large as the diameter of the

rod lens main body and smaller than or equal to another value approximately equal to three times as large as the diameter of the rod lens main body.

40. A line-beam generating optical system, comprising:

a light source emitting a light beam;

a collimating lens converting the light beam emitted from the light source into a collimated light;

a first half mirror separating the collimated light into a first reflected collimated light and a first transmitted collimated light;

a first rod lens disposed on an optical path of the first reflected collimated light;

a second half mirror disposed on an optical path of the first transmitted collimated light and separating the first transmitted collimated light into a second reflected collimated light and a second transmitted collimated light;

a second rod lens disposed on an optical path of the second reflected collimated light; and

a third rod lens disposed on an optical path of the second transmitted collimated light;

wherein each of the first rod lens, second rod lens, and third rod lens includes a rod lens main body substantially cylindrical in shape with a circumferential side surface extending along a corresponding axis and generating a transmitted light by transmitting at least a

portion of the corresponding collimated light, and

wherein a light separating portion is formed on a portion of the circumferential side surface of at least one of the first, second, and third rod lenses, the light separating portion separating the corresponding collimated light into a transmitted light and a reflected light, thereby generating a line beam made from the transmitted light and the reflected light.

41. A line-beam generating optical system according to Claim 40, wherein the light separating portion of each of the at least one of the first, second, and third rod lenses is formed in an area of a circumferential side surface of the corresponding rod lens main body at its side, on which the corresponding collimated light falls incident, the area being defined around the axis with an angle of 2 ϕ max (radians) that satisfies the following two inequalities:

$$4\phi\,\mathrm{max}-2\sin^{-1}\left(\frac{\sin\phi\,\mathrm{max}}{n}\right)-\pi\geq 0,$$

$$2\phi\,\mathrm{max}\leq\pi,$$

wherein the corresponding rod lens main body has a refractive index n and a ratio of a circumference of a circle to the diameter of the circle is π.

42. A line-beam generating optical system according to Claim 40, wherein the first half mirror transmits the first reflected collimated light, which has been reflected off the

first half mirror and which has been reflected by the first rod lens to return to the first half mirror, thereby obtaining another transmitted collimated light by transmitting the first reflected collimated light through the first half mirror.

43. A line-beam generating optical system, comprising:

a light source emitting a light beam;

a collimating lens converting the light beam emitted from the light source into a collimated light;

a first half mirror separating the collimated light into a first reflected collimated light and a first transmitted collimated light;

a first rod lens disposed on an optical path of the first reflected collimated light;

a second half mirror disposed on an optical path of the first transmitted collimated light and separating the first transmitted collimated light into a second reflected collimated light and a second transmitted collimated light;

a second rod lens disposed on an optical path of the second reflected collimated light; and

a third rod lens disposed on an optical path of the second transmitted collimated light,

wherein each of the first rod lens, second rod lens, and third rod lens includes a rod lens main body substantially cylindrical in shape with a circumferential

side surface extending along a corresponding axis and generating a transmitted light by transmitting at least a portion of the corresponding collimated light, and

wherein a light reflecting region is formed over a part of the circumferential side surface of at least one of the first, second, and third rod lenses along the circumferential direction and receives and reflects a portion of the incident collimated light, the corresponding rod lens main body including a transmitting region which receives and transmits the remaining portion of the incident light.

44. A line-beam generating optical system according to Claim 43, wherein the first half mirror transmits the first reflected collimated light, which has been reflected off the first half mirror and which has been reflected by the first rod lens to return to the first half mirror, thereby obtaining another transmitted collimated light by transmitting the first reflected collimated light through the first half mirror.

45. A laser marking apparatus comprising:

a laser emitting a light beam along an optical axis;

a collimating lens converting the light beam emitted from the laser into a collimated light;

a rod lens including:

a reflecting portion generating a reflected

light by reflecting at least a portion of the collimated light that falls incident on the rod lens along the optical axis; and

a rod lens main body of substantially a cylindrical shape generating a transmitted light by transmitting at least a remaining portion of the incident collimated light, the rod lens main body having an axis that extends substantially perpendicularly to the optical axis and a circumferential side surface extending along the axis, the circumferential side surface being substantially cylindrical in shape and encircling the axis in a circumferential direction, the reflecting portion and the rod lens main body cooperating to generate a line beam made from both of the reflected light and the transmitted light; and

a support portion supporting the laser, the collimating lens, and the rod lens.

46. A laser marking apparatus according to Claim 45, wherein the reflecting portion includes a light separating portion, which is formed on at least a part of the circumferential side surface of the rod lens main body along the circumferential direction and which separates the incident light into both of the transmitted light and the reflected light.

47. A laser marking apparatus according to Claim 46,

further comprising a half mirror separating the collimated light into a first reflected collimated light and a first transmitted collimated light;

wherein the rod lens includes:

a first rod lens disposed on an optical path of the first reflected collimated light; and

a second rod lens disposed on an optical path of the first transmitted collimated light,

wherein each of the first and second rod lenses has the light separating portion, and

wherein the light separating portion of each rod lens is formed in an area of the circumferential side surface of the corresponding rod lens main body at its side, on which the corresponding collimated light falls incident, the area being defined around the axis with an angle of 2 ϕ max (radians) that satisfies the following two inequalities:

$$4\phi \max - 2\sin^{-1}\left(\frac{\sin\phi \max}{n}\right) - \pi \geq 0,$$

$$2\phi \max \leq \pi,$$

wherein the corresponding rod lens main body has a refractive index n and a ratio of a circumference of a circle to the diameter of the circle is π.

48. A laser marking apparatus according to Claim 46, further comprising a half mirror separating the collimated light into a reflected collimated light and a transmitted

collimated light;

wherein the rod lens includes at least one of a rod lens disposed on an optical path of the reflected collimated light and another rod lens disposed on an optical path of the transmitted collimated light,

wherein the light separating portion of each of the at least one rod lens is formed in an area of the circumferential side surface of the corresponding rod lens main body at its side, on which the corresponding collimated light falls incident, the area being defined around the axis with an angle of 2 ϕ max (radians) that satisfies the following two inequalities:

$$4\phi \max - 2\sin^{-1}\left(\frac{\sin\phi \max}{n}\right) - \pi \geq 0,$$

$$2\phi \max \leq \pi,$$

wherein the rod lens main body has a refractive index n and a ratio of a circumference of a circle to the diameter of the circle is π.

49. A laser marking apparatus according to Claim 46, wherein the light separating portion includes a light separating film formed over the at least a part of the circumferential side surface in the circumferential direction.

50. A laser marking apparatus according to Claim 45, wherein the reflecting portion includes a light reflecting

region which is formed over a part of the circumferential side surface along the circumferential direction and which receives and reflects a portion of the incident collimated light,

wherein the rod lens main body includes a transmitting region which receives and transmits the remaining portion of the incident light.

51. A laser marking apparatus according to Claim 50, further comprising a half mirror separating the collimated light into a first reflected collimated light and a first transmitted collimated light;

wherein the rod lens includes:

a first rod lens disposed on an optical path of the first reflected collimated light; and

a second rod lens disposed on an optical path of the first transmitted collimated light, thereby forming at least two line beams.

52. A laser marking apparatus according to Claim 50, further comprising a half mirror separating the collimated light into a reflected collimated light and a transmitted collimated light,

wherein the rod lens includes at least one of a rod lens disposed on an optical path of the reflected collimated light and another rod lens disposed on an optical path of the transmitted collimated light, thereby forming at least

one line beam.

53. A laser marking apparatus according to Claim 45, wherein the reflecting portion includes a reflecting member which is disposed near the rod lens main body and which generates a reflected light by reflecting and receiving a portion of the incident collimated light in a direction toward the rod lens main body, and

wherein the rod lens main body generates a line beam by transmitting both of the remaining portion of the incident collimated light and the reflected light.

54. A laser marking apparatus according to Claim 53, wherein the reflecting member extends along the axis of the rod lens main body and forms a predetermined angle with respect to the optical axis of the incident collimated light, thereby reflecting the collimated light incident to the reflecting member toward the rod lens main body.

55. A laser marking apparatus according to Claim 53, wherein the reflecting member has two reflecting surfaces, each of which contacts the circumferential side surface of the rod lens main body and forms a predetermined angle with the optical axis of the collimated light, thereby reflecting the received portion of the collimated light toward the rod lens main body, and

wherein the rod lens main body converts, into a line beam, both of the portion of the collimated light reflected

by the reflecting member and the remaining portion of the collimated light that falls directly incident on the rod lens main body.

56. A laser marking apparatus according to Claim 55, wherein the predetermined angle is greater than approximately 0° and less than or equal to approximately 30°.

57. A laser marking apparatus according to Claim 53, wherein the collimating lens emits, toward the rod lens, the collimated light having a beam diameter in a cross section substantially perpendicular to the optical axis of the collimated light, the beam diameter being greater than a value equal to zero times as large as the diameter of the rod lens main body and smaller than or equal to another value approximately equal to three times as large as the diameter of the rod lens main body.

58. A laser marking apparatus, comprising:

a laser emitting a light beam;

a collimating lens converting the light beam emitted from the laser into a collimated light;

a first half mirror separating the collimated light into a first reflected collimated light and a first transmitted collimated light;

a first rod lens disposed on an optical path of the first reflected collimated light;

a second half mirror disposed on an optical path of

the first transmitted collimated light and separating the first transmitted collimated light into a second reflected collimated light and a second transmitted collimated light;

a second rod lens disposed on an optical path of the second reflected collimated light;

a third rod lens disposed on an optical path of the second transmitted collimated light; and

a support portion supporting the laser, the collimating lens, the first and second half mirrors, and the first, second, and third rod lenses,

wherein each of the first rod lens, second rod lens, and third rod lens includes a rod lens main body substantially cylindrical in shape with a circumferential side surface extending along a corresponding axis and generating a transmitted light by transmitting at least a portion of the corresponding collimated light, and

wherein a light separating portion is formed on a portion of the circumferential side surface of at least one of the first, second, and third rod lenses, the light separating portion separating the corresponding collimated light into a transmitted light and a reflected light, thereby generating a line beam made from the transmitted light and the reflected light.

59. A laser marking apparatus, comprising:

a laser emitting a light beam;

a collimating lens converting the light beam emitted from the laser into a collimated light;

a first half mirror separating the collimated light into a first reflected collimated light and a first transmitted collimated light;

a first rod lens disposed on an optical path of the first reflected collimated light;

a second half mirror disposed on an optical path of the first transmitted collimated light and separating the first transmitted collimated light into a second reflected collimated light and a second transmitted collimated light;

a second rod lens disposed on an optical path of the second reflected collimated light;

a third rod lens disposed on an optical path of the second transmitted collimated light; and

a support portion supporting the laser, the collimating lens, the first and second half mirrors, and the first, second, and third rod lenses,

wherein each of the first rod lens, second rod lens, and third rod lens includes a rod lens main body substantially cylindrical in shape with a circumferential side surface extending along a corresponding axis and generating a transmitted light by transmitting at least a portion of the corresponding collimated light, and

wherein a light reflecting region is formed over a

part of the circumferential side surface of at least one of the first, second, and third rod lenses along the circumferential direction and receives and reflects a portion of the incident collimated light, the corresponding rod lens main body including a transmitting region which receives and transmits the remaining portion of the incident light.